PROJECT facts

U.S. DEPARTMENT OF ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Sequestration

09/2002

ADVANCED OXYFUEL BOILERS AND PROCESS HEATERS FOR COST EFFECTIVE CO_2 CAPTURE AND SEQUESTRATION

CONTACT POINTS

Scott M. Klara
Sequestration Product Manager
National Energy Technology Laboratory
626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236
412-386-4864
scott.klara@netl.doe.gov

Michael K. Knaggs
Project Manager
National Energy Technology Laboratory
3610 Collins Ferry Road
Morgantown, WV 26505
304-285-4926
michael.knaggs@netl.doe.gov

David Thompson
Praxair, Inc.
175 East Park Drive
P.O. Box 44
Tonawanda, NY 14151-0044
716-879-2394
Dave_Thompson@praxair.com

CUSTOMER SERVICE

800-553-7681

WEBSITE

www.netl.doe.gov

Background

Reducing CO_2 from large stationary combustion systems has been targeted as a cost efficient means of reducing the emission of greenhouse gases from fossil fuel combustion systems. A number of concepts exist or have been proposed to reduce emissions, including fuel switching, efficiency improvements, CO_2 capture from conventional flue gas streams, and oxy-fuel fired systems with CO_2 capture. Switching fuels from coal to lower carbon fuels such as natural gas can reduce emissions, but severely restricts the nation's fuel flexibility and underutilizes the most abundant natural resource in the United States. Enhancing site efficiency by building natural gas combined cycle plants or making efficiency improving plant modifications can also significantly reduce emissions of greenhouse gases. However, these options simply do not provide enough reduction in emissions to mitigate the growing problem of global warming.

One economical solution to overcome these problems is to switch to oxy-fuel combustion. The use of oxygen in place of air results in a much lower volume of flue gas, which enhances thermal efficiency, thereby lowering CO_2 emissions. This four-year project will advance the integration of oxygen transport membranes (OTM) into oxyfired boilers from the bench scale to the point-of-readiness for engineering scaleup. The development of this novel boiler will require both Praxir's expertise in OTM development and oxy-fuel combustion and the experience of Alstom Power in boiler development and manufacturing. These highly efficient boilers, through incorporation of lower cost OTM oxygen generation technology, can economically provide a significant portion of the required reductions in greenhouse gases.

Primary Project Goal

The object of this project is to develop and demonstrate the integration of a novel ceramic oxygen transport membrane (OTM) with the combustion process to enhance boiler efficiency and carbon dioxide recovery.

Advanced Oxyfuel Boilers and Process Heaters for Cost Effective CO_2 Capture and Sequestration

PARTNERS

Praxair

Alstom Power

COST

Total Project Value:	$5,836,487
DOE/Non-DOE Share:	$4,085,537 / $1,750,950

Objectives

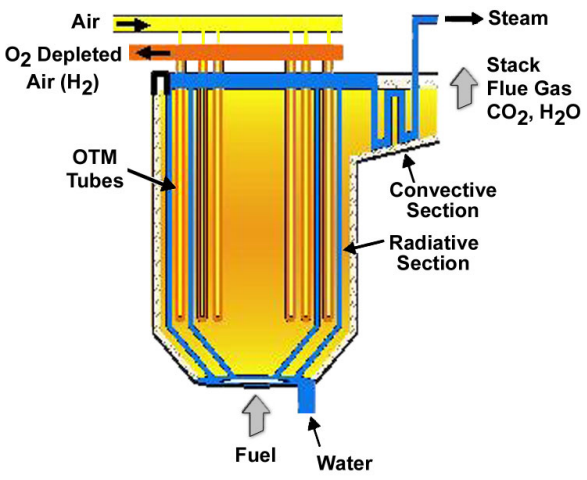
- Identify the optimal design based on technical performance; identify and demonstrate the most promising OTM materials for the integrated system; and develop a conceptual design for a laboratory scale boiler simulator.
- Perform economic analyses throughout the program to ensure the novel boiler will bring economic value to both the industrial customers and to the participating companies.
- Complete project by December 2005.

Accomplishments

A ceramic membrane and seal assembly have been developed for thermal integration between the high temperature membrane and the combustion process. Alstom Power has initiated modeling studies to understand and predict the combustion characteristics of oxy-fuel technology. Current efforts are focusing on laboratory scale evaluations for integration of OTM with the combustion process.

Benefits

The development of a novel oxy-fuel boiler will significantly reduce the complexity of CO_2 capture, drastically reduce the cost of carbon sequestration, and offer increased thermal efficiency and reduced pollution emissions. This highly efficient boiler will economically provide a significant portion of the required reductions in greenhouse gases. Gasification plants which integrate OTM technology will have higher efficiency, lower cost of electricity, and lower emissions of pollutants compared to using a conventional cryogenic air separation unit.



Praxair Advanced Boiler

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